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PROJECT DETAILS

Project	Retinal Implant Chip for the Blind
Principal Investigators	John Wyatt (MIT) Joseph Rizzo (Massachusetts Eye and Ear Infirmary)
Student	Shawn K. Kelly (MIT)
Year	1997 - 2002
Abstract	The Retinal Implant Project, a collaboration between the Massachusetts Institute of Technology and the Massachusetts Eye and Ear Infirmary, involves the design of a microelectronic prosthesis to help restore some functional vision to patients with retinal diseases such as retinitis pigmentosa and macular degeneration. These patients lose vision as a result of degeneration of the photoreceptor cell layer in the retina. The implant chip will sit against the retina and receive power and visual signal information from a wireless driver outside the eye. It will electrically stimulate the healthy ganglion cells on the front surface of the retina, which send visual information to the brain. The concept is similar in principal to the cochlear implant for the deaf. One focus of the project has been retinal stimulation trials on humans. In these trials, a retinal surgeon temporarily inserts a flexible microfabricated electrode array into the eye and against the retina. The other end of this device remains outside the eye, connected to stimulation circuitry. The patient describes what he or she sees when current is passed through the electrodes. After a few hours of stimulation, the electrode array is removed from the eye. These trials have generated phosphene perception, and some very crude form percepts. MIT graduate student Shawn Kelly designed, built and tested the battery-powered stimulator, put it through hospital approval proceedures, and operates it during surgery as part of the experimental team. This work was funded in part by Catalyst. Mr. Kelly's doctoral project is to create an efficient power system for an implantable chip. In his RF-driven design, a primary coil outside the eye

	generates a magnetic field, which is received by a secondary coil implanted in the eye. The resulting AC voltage passes through an active rectifier, which is more efficient than a standard diode. The electrodes are stimulated in an efficient manner, and capacitively stored charge is recovered from stimulated electrodes to stimulate other electrodes. This system will allow efficient power delivery to the electrodes, reducing excess heat generation in the eye, and allowing more electrodes to be used. All the power-saving features in Mr. Kelly's design would be beneficial in other implantable stimulation systems, such as cardiac pacemakers and cochlear implants. We are grateful to Catalyst for funding this doctoral project in its entirety.
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